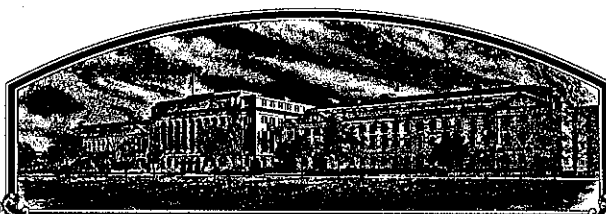


No.



9000208

THE UNITED STATES OF AMERICA

TO ALL TO WHOM THESE PRESENTS SHALL COME:

Minnesota Agricultural Experiment Station

Whereas, THERE HAS BEEN PRESENTED TO THE
Secretary of Agriculture

AN APPLICATION REQUESTING A CERTIFICATE OF PROTECTION FOR AN ALLEGED NOVEL VARIETY OF SEXUALLY REPRODUCED PLANT, THE NAME AND DESCRIPTION OF WHICH ARE CONTAINED IN THE APPLICATION AND EXHIBITS, A COPY OF WHICH IS HEREUNTO ANNEXED AND MADE A PART HEREOF, AND THE VARIOUS REQUIREMENTS OF LAW IN SUCH CASES MADE AND PROVIDED HAVE BEEN COMPLIED WITH, AND THE TITLE THERETO IS, FROM THE RECORDS OF THE PLANT VARIETY PROTECTION OFFICE, IN THE APPLICANT(S) INDICATED IN THE SAID COPY, AND WHEREAS, UPON DUE EXAMINATION MADE, THE SAID APPLICANT(S) IS (ARE) ADJUDGED TO BE ENTITLED TO A CERTIFICATE OF PLANT VARIETY PROTECTION UNDER THE LAW.

NOW, THEREFORE, THIS CERTIFICATE OF PLANT VARIETY PROTECTION IS TO GRANT UNTO THE SAID APPLICANT(S) AND THE SUCCESSORS, HEIRS OR ASSIGNS OF THE SAID APPLICANT(S) FOR THE TERM OF *eighteen* YEARS FROM THE DATE OF THIS GRANT, SUBJECT TO THE PAYMENT OF THE REQUIRED FEES AND PERIODIC REPLENISHMENT OF VIABLE BASIC SEED OF THE VARIETY IN A PUBLIC REPOSITORY AS PROVIDED BY LAW, THE RIGHT TO EXCLUDE OTHERS FROM SELLING THE VARIETY, OR OFFERING IT FOR SALE, OR REPRODUCING IT, OR IMPORTING IT, OR EXPORTING IT, OR USING IT IN PRODUCING A HYBRID OR DIFFERENT VARIETY THEREFROM, TO THE EXTENT PROVIDED BY THE PLANT VARIETY PROTECTION ACT. UNITED STATES SEED OF THIS VARIETY (1) SHALL BE SOLD BY VARIETY NAME ONLY AS OF CERTIFIED SEED AND (2) SHALL CONFORM TO THE NUMBER OF GENERATIONS BY THE OWNER OF THE RIGHTS. (84 STAT. 1542, AS AMENDED, 7 U.S.C. 2321 ET SEQ.)

BARLEY

'Excel'

In Testimony Whereof, I have hereunto set
my hand and caused the seal of the Plant
Variety Protection Office to be affixed
at the City of Washington, D. C.
this 31st day of May in
the year of our Lord one thousand nine
hundred and ninety-one.

Attest:

Kenneth Evans
Commissioner
Plant Variety Protection Office
Agricultural Marketing Service

Ed Madigan
Secretary of Agriculture

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE

APPLICATION FOR PLANT VARIETY PROTECTION CERTIFICATE

(Instructions on reverse)

Application is required in order to determine if a plant variety protection certificate is to be issued (7 U.S.C. 2421). Information is held confidential until certificate is issued (7 U.S.C. 2426).

1. NAME OF APPLICANT(S) (as it is to appear on the Certificate) Minnesota Agricultural Experiment Station		2. TEMPORARY DESIGNATION OR EXPERIMENTAL NO. Minn. M52	3. VARIETY NAME Excel
4. ADDRESS (street and no. or R.F.D. no., city, state, and ZIP) Univ. of Minnesota, 220 Coffey Hall, 1420 Eckles Ave., St. Paul, MN 55108		5. PHONE (include area code) 612-625-7278	FOR OFFICIAL USE ONLY PVPO NUMBER <div style="font-size: 2em; text-align: center;">9000208</div> F I L I N G Date <u>June 18, 1990</u> Time <input type="checkbox"/> A.M. <input type="checkbox"/> P.M. F E E S Filing and Examination Fee: \$ <u>2150.-</u> Date <u>June 18, 1990</u> R E C E I V E D Certificate Fee: \$ <u>150.00</u> Date <u>May 15, 1991</u>
6. GENUS AND SPECIES NAME Hordeum vulgare L.	7. FAMILY NAME (Botanical) Graminae		
8. CROP KIND NAME (Common Name) Barley, six-rowed	9. DATE OF DETERMINATION Feb. 1, 1990		
10. IF THE APPLICANT NAMED IS NOT A "PERSON," GIVE FORM OF ORGANIZATION (Corporation, partnership, association, etc.) State, Experiment Station			
11. IF INCORPORATED, GIVE STATE OF INCORPORATION		12. DATE OF INCORPORATION	
13. NAME AND ADDRESS OF APPLICANT REPRESENTATIVE(S), IF ANY, TO SERVE IN THIS APPLICATION AND RECEIVE ALL PAPERS Donald C. Rasmussen Department of Agronomy and Plant Genetics University of Minnesota St. Paul, MN 55108			

PHONE (include area code):

14. CHECK APPROPRIATE BOX FOR EACH ATTACHMENT SUBMITTED (Follow INSTRUCTIONS on reverse)

- a. ☒ Exhibit A, Origin and Breeding History of the Variety.
- b. ☒ Exhibit B, Novelty Statement.
- c. ☒ Exhibit C, Objective Description of Variety.
- d. ☐ Exhibit D, Additional Description of Variety.
- e. ☒ Exhibit E, Statement of the Basis of Applicant's Ownership.
- f. ☒ Seed Sample (2,500 viable untreated seeds). Date Seed Sample mailed to Plant Variety Protection Office _____
- g. ☒ Filing and Examination Fee (\$2,150) made payable to "Treasurer of the United States."

15. DOES THE APPLICANT(S) SPECIFY THAT SEED OF THIS VARIETY BE SOLD BY VARIETY NAME ONLY AS A CLASS OF CERTIFIED SEED? (See section 83(a) of the Plant Variety Protection Act.)
☒ YES (If "YES," answer items 16 and 17 below) ☐ NO (If "NO," skip to item 18 below)

16. DOES THE APPLICANT(S) SPECIFY THAT THIS VARIETY BE LIMITED AS TO NUMBER OF GENERATIONS?
☒ YES ☐ NO

17. IF "YES" TO ITEM 16, WHICH CLASSES OF PRODUCTION BEYOND BREEDER SEED?
☒ FOUNDATION ☒ REGISTERED ☒ CERTIFIED

18. DID THE APPLICANT(S) PREVIOUSLY FILE FOR PROTECTION OF THE VARIETY IN THE U.S.?
☐ YES (If "YES," through ☐ Plant Variety Protection Act ☐ Patent Act. Give date: _____)
☒ NO

19. HAS THE VARIETY BEEN RELEASED, USED, OFFERED FOR SALE, OR MARKETING IN THE U.S. OR OTHER COUNTRIES?
☒ YES (If "YES," give names of countries and dates) United States of America, February 1990
☐ NO → DCR 6/1/90

20. The applicant(s) declare(s) that a viable sample of basic seeds of this variety will be furnished with the application and will be replenished upon request in accordance with such regulations as may be applicable.
 The undersigned applicant(s) is (are) the owner(s) of this sexually reproduced novel plant variety, and believe(s) that the variety is distinct, uniform, and stable as required in section 41, and is entitled to protection under the provisions of section 42 of the Plant Variety Protection Act.
 Applicant(s) is (are) informed that false representation herein can jeopardize protection and result in penalties.

SIGNATURE OF APPLICANT [Owner(s)] Donald C Rasmussen	CAPACITY OR TITLE Professor	DATE June 5 1990
SIGNATURE OF APPLICANT [Owner(s)] C. Eugene Allen	CAPACITY OR TITLE Director	DATE June 12, 1990

Origin and Breeding History of Excel Barley

'Excel' originated from the cross 'Cree'/'Bonanza'/'Manker'/3/2*Robust made in 1981. Individual plants were selected in the F_2 generation. F_3 and F_4 generations were grown in the greenhouse using a single seed descent procedure. The F_5 generation was grown in the field and selection was practiced for several agronomic and malting quality traits. Excel traces to a single plant taken at random from a selected F_5 line. Seed of the single plant was increased in a winter nursery in Texas and replicated testing of the selection was begun in the F_7 generation in 1984. Testing for disease and agronomic merit continued through 1989 in statewide trials, and in regional trials from 1986 through 1989. Malting and brewing quality was evaluated at the USDA Barley and Malt Laboratory, Madison, Wisconsin and in industry (pilot and plant scale tests) starting in 1983 (F_5 generation) and continued through 1989. Reselection was done in 1986 (F_9 generation) when 60 head rows were bulked to constitute the line. Excel contains no off-type plants.

Seed stocks will be maintained by the Minnesota Agricultural Experiment Station and the Minnesota Crop Improvement Association. Certification will be limited to three generations after breeder seed: Foundation, Registered and Certified. Certified seed will be offered for sale in 1991. Application will be made for protection via the "Certification Option."

Exhibit B

Novelty Statement

'Excel' barley (Hordeum vulgare L.) (Reg. No. _____, P.I. _____) was developed by the Minnesota Agricultural Experiment Station and released 15 Feb. 1990. The breeding procedure was a combination of pedigree and single seed descent. Excel has been tested in the upper midwestern states where it will be grown. It may be suitable for growing in the western barley growing states but this is not determined.

Excel is a six-rowed, smooth-awned spring barley. It is ^{most} similar to Robust (a parent) in appearance; however, it can be distinguished from Robust as Excel has long rachilla hairs while Robust has short hairs. Kernels of Excel are covered, medium size, and with a white aleurone. The spike is medium-lax, medium long, and semi-erect. It is medium late, intermediate height, and has moderately strong straw. It is resistant to races of stem rust and spot blotch which occur in Minnesota. It is susceptible to prevalent races of loose smut.

Yields of Excel have exceeded those of check cultivars in Minnesota Trials (Table 1) and in the Regional Mississippi Valley Nursery (Table 2). Robust and Morex provide the appropriate comparison since they currently rank number one and two in acres planted in Minnesota and in the upper midwestern United States. Excel is similar to Robust in heading date, lodging reaction, and in resistance to disease (Table 3). It is modestly shorter (two inches) than Robust and has a lower percentage of plump kernels. Quality information from small scale testing of Excel is given in Table 4. Excel is low in protein, high in extract, low in fine-coarse difference and high in alpha amylase. All of these traits are in the desired direction compared to Morex, the industry standard for malting quality in six-rowed barley. Excel was approved for malting and brewing by the American Malting Barley Association in May 1990.

as per letter
dated 3/6/91. SK

Table 1. Grain yields in bu/acre of Excel, Morex, and Robust; 1985-89.

Variety	Location				
	Crookston 101	Morris 7	Stephen 4	St. Paul 9	Roseau 3
					Average 33
Morex	80	73	76	63	61
Robust	83	75	73	68	80
Excel	87	75	82	69	85
					71.7
					75.8
					78.4

1Number of trials.

Table 2. Grain yields of Excel, Morex, and Robust in Mississippi Valley Nursery for 32 station years.

Variety	1986 91	1987 9	1988 5	1989 9	Mean 32
Morex	80	71	59	71	70.3
Robust	96	75	61	75	76.8
Excel	100	77	65	77	79.8

1Number of stations.

Table 3. Characteristics of Excel, Morex, and Robust; 1987-89.

	Heading	Height	Lodging	Plump kernels	Stem ¹ rust	Spot ¹ blotch	Net blotch
	(June)	(inches)	(%)	(%)	-----rating ² ----	score ³	
	18 ¹	17	4	19	--	--	5
Morex	18	31	57	66	R	MR	3.4
Robust	20	31	39	72	R	R	2.1
Excel	20	29	39	62	R	R	2.0

¹Number of trials; 2R = resistant, MR = moderately resistant, S = susceptible; 31-5, 1 = not resistant.

Table 4. Quality comparisons of Excel, Morex and Robust; 1984-88 data¹.

	Barley protein	Plump barley (on 6/64)	Color agtron	Malt extract	Fine course diff.	Wort protein	Diastatic power	Alpha amylase
	%	%	--	%	%	%	L°	20°U
Morex	12.6	83	54	77.1	2.1	4.64	143	40.4
Robust	12.8	87	47	76.5	2.4	4.43	137	30.4
Excel	11.9	78	50	77.8	1.5	4.78	140	41.9

¹Seven station years.

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U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL MARKETING SERVICE
LIVESTOCK AND SEED DIVISION
BELTSVILLE, MARYLAND 20705

EXHIBIT C
(Barley)

OBJECTIVE DESCRIPTION OF VARIETY
BARLEY (*HORDEUM VULGARE*)

INSTRUCTIONS: See Reverse.

NAME OF APPLICANT(S)

Minnesota Agricultural Experiment Station

ADDRESS (Street and No. or R.F.D. No., City, State, and ZIP Code)

University of Minnesota
St. Paul, MN 55108

FOR OFFICIAL USE ONLY

PVPO NUMBER

9000208

VARIETY NAME OR TEMPORARY
DESIGNATION

Excel

Place the appropriate number that describes the varietal character of this variety in the boxes below.
Place a zero in first box (i.e. or) when number is either 99 or less or 9 or less.

1. GROWTH HABIT:

1 - SPRING 2 - FACULTATIVE WINTER 3 - WINTER Early Growth: 1 - PROSTRATE 2 - SEMIPROSTRATE
3 - ERECT

2. MATURITY (50% Flowering):

1 - EARLY (California Mariout) 2 - MIDSEASON (Betzes) 3 - LATE (Frontier)

No. of days Earlier than } 1 - BETZES 2 - CALIFORNIA MARIOUT 3 - CONQUEST 4 - DICKSON
 No. of days Later than } 5 - PIROLINE 6 - PRIMUS 7 - UNITAN

3. PLANT HEIGHT (From soil level to top of head):

1 - SEMIDWARF 2 - SHORT (California Mariout) 3 - MEDIUM TALL (Betzes) 4 - TALL (Conquest)

Cm. Shorter than } 1 - BETZES 2 - CALIFORNIA MARIOUT 3 - CONQUEST 4 - DICKSON
 Cm. Taller than } 5 - PIROLINE 6 - PRIMUS 7 - UNITAN

4. STEM:

Exertion (Flag to spike at maturity): 1 - 0 - 3 cm. 2 - 3 - 10 cm. Anthocyanin: 1 - ABSENT 2 - PRESENT
3 - 10 - 15 cm.

NO. OF NODES (Originating from node above ground)

Collar Shape: 1 - CLOSED 2 - V-SHAPED 3 - OPEN Shape of Neck: 1 - STRAIGHT 2 - SNAKY
4 - MODIFIED CLOSED OR OPEN 3 - OTHER (Specify) .

5. LEAF:

Basal leaf sheath (seedling): 1 - GLABROUS 2 - PUBESCENT Position of flag leaf (at boot stage): 1 - DROOPING
2 - UPRIGHT

Waxiness: 1 - ABSENT (Glossy) 2 - SLIGHTLY WAXY
3 - WAXY

MM. WIDTH (First leaf below flag leaf)

CM. LENGTH (First leaf below flag leaf)

Anthocyanin in leaf sheath: 1 - ABSENT 2 - PRESENT

6. HEAD:

Type: 1 - TWO-ROWED 2 - SIX-ROWED Density: 1 - LAX 2 - ERECT (Not dense)
3 - ERECT (Dense)

Shape: 1 - TAPERING 2 - STRAP 3 - CLAVATE Waxiness: 1 - ABSENT (Glossy) 2 - SLIGHTLY WAXY
4 - OTHER (Specify) 3 - WAXY

Lateral Kernels Overlap: 1 - NONE 2 - AT TIP Rachis (Hair on edge): 1 - LACKING 2 - FEW 3 - COVERED
3 - 1/4 - 1/2 OF HEAD

7. GLUME:

Length: 1 - 1/3 OF LEMMA 2 - 1/2 OF LEMMA Hairs: 1 - NONE 2 - SHORT 3 - LONG
3 - MORE THAN 1/2 OF LEMMA

Hair covering: 1 - NONE 2 - RESTRICTED TO MIDDLE 3 - CONFINED TO BAND 4 - COMPLETELY COVERED

Awns: 1 - LESS THAN EQUAL TO LENGTH OF GLUMES 2 - EQUAL TO LENGTH OF GLUMES
3 - MORE THAN EQUAL TO LENGTH OF GLUMES

Awn Surface: 1 - SMOOTH 2 - SEMISMOOTH 3 - ROUGH

6

8. LEMMA:

☐ 5 Awn: 1 = AWNLESS 2 = AWNLETS ON CENTRAL ROWS, AWNLESS ON LATERAL ROWS
3 = SHORT ON CENTRAL ROWS, AWNLETS ON LATERAL ROWS 4 = SHORT (less than equal to length of spike)
5 = LONG (longer than spike) 6 = HOODED

☐ 2 Awn Surface: 1 = AWNLESS 2 = SMOOTH 3 = SEMISMOOTH 4 = ROUGH

☐ 2 Teeth: 1 = ABSENT 2 = FEW 3 = NUMEROUS ☐ 2 Hair: 1 = ABSENT 2 = PRESENT

☐ 3 Shape of base: 1 = DEPRESSION 2 = SLIGHT CREASE 3 = TRANSVERSE CREASE ☐ 2 Rachilla Hairs: 1 = SHORT 2 = LONG

9. STIGMA:

☐ 2 Hairs: 1 = FEW 2 = MANY

10. SEED:

☐ 2 Type: 1 = NAKED 2 = COVERED ☐ 1 Hairs on Ventral Furrow: 1 = ABSENT 2 = PRESENT

☐ 3 Length: 1 = SHORT (8.0 mm.) 2 = SHORT TO MIDLONG (7.5 - 9.0 mm.) 3 = MIDLONG (8.5 - 9.5 mm.)
4 = MIDLONG TO LONG (9.0 - 10.5 mm.) 5 = LONG (10.0 mm.)

☐ 2 Wrinkling of hull: 1 = NAKED 2 = SLIGHTLY WRINKLED 3 = SEMIWRINKLED 4 = WRINKLED

☐ 1 Aleurone Color: 1 = COLORLESS (White or Yellow) 2 = BLUE

☐ 0 ☐ 0 PERCENT ABORTIVE ☐ 3 ☐ 2 GMS. PER 1000 SEEDS

11. DISEASE: (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

<input type="checkbox"/> 0 SEPTORIA	<input type="checkbox"/> 0 NET BLOTCH	<input type="checkbox"/> 2 SPOT BLOTCH	<input type="checkbox"/> 1 POWDERY MILDEW
<input type="checkbox"/> 1 LOOSE SMUT	<input type="checkbox"/> 0 BACTERIAL BLIGHT	<input type="checkbox"/> 0 COVERED SMUT	<input type="checkbox"/> 0 FALSE LOOSE SMUT
<input type="checkbox"/> 2 STEM RUST	<input type="checkbox"/> 0 LEAF RUST	<input type="checkbox"/> 0 SCAB	<input type="checkbox"/> 0 SCALD
<input type="checkbox"/> 0 AY	<input type="checkbox"/> 0 BSMV	<input type="checkbox"/> 0 BYDV	<input type="checkbox"/> OTHER (Specify)

12. INSECT: (0 = Not tested, 1 = Susceptible, 2 = Resistant)

<input type="checkbox"/> 0 GREEN BUG	<input type="checkbox"/> 0 ENGLISH GRAIN APHID	<input type="checkbox"/> 0 CHINCH BUG	<input type="checkbox"/> 0 ARMYWORM
<input type="checkbox"/> 0 GRASS HOPPERS	<input type="checkbox"/> CEREAL LEAF BEETLE	<input type="checkbox"/> OTHER (Specify)	
HESSIAN FLY RACES		<input type="checkbox"/> 0 GP	<input type="checkbox"/> 0 A
		<input type="checkbox"/> 0 B	<input type="checkbox"/> 0 C
		<input type="checkbox"/> 0 D	<input type="checkbox"/> 0 E
		<input type="checkbox"/> 0 F	<input type="checkbox"/> 0 G

13. CHEMICAL (0 = Not Tested, 1 = Susceptible, 2 = Resistant)

☐ 0 DDT ☐ OTHER (Specify)

14. INDICATE WHICH VARIETY MOST CLOSELY RESEMBLES THAT SUBMITTED:

CHARACTER	NAME OF VARIETY	CHARACTER	NAME OF VARIETY
Plant tillering	Robust	Seed size	Morex
Leaf size	Robust	Coleoptile elongation	Robust
Leaf color	Robust	Seedling pigmentation	Robust
Leaf carriage	Robust		

REFERENCES: The following publications may be used as a reference aid for the standardization of character descriptions and terms used in this form:

1. Wiebe, G. A., and D. A. Reid, 1961, Classification of Barley Varieties Grown in the United States and Canada in 1958, Technical Bulletin No. 1224, U.S. Dept. of Agriculture.
2. Reid, D. A., and G. A. Wiebe, 1968, Barley: Origin, Botany, Culture, Winter Hardiness, Genetics, Utilization, Pests, Agriculture Handbook No. 338, U.S. Dept. of Agriculture. pp. 61 - 84.
3. Malting Barley Improvement Association, Milwaukee, Wisconsin, 1971, Barley Variety Dictionary.

COLOR: Nickerson's or any recognized color fan may be used to determine color of the described variety.

9000208

Exhibit E

Statement of the Basis of Applicant's Ownership

The Minnesota Agricultural Experiment Station is the owner of Excel. The Minnesota Agricultural Experiment Station is the employer of the breeder who developed Excel.